Post-print (accepted) version (2 year embargo):
The Dynamics of Disability and Work In Britain

Melanie K. Jones[†], Rhys Davies[*] and Stephen Drinkwater[•]

[†]Cardiff Business School, Cardiff University

[*]WISERD, Cardiff University

[•]Business School, University of Roehampton, London

ABSTRACT

This paper examines the dynamic relationship between work-limiting disability and labour market outcomes using longitudinal data created by matching individuals in the Local Labour Force Survey (2004-2010). By applying event-study methods, changes in employment are traced through the onset of, and exit from, disability. These relationships are examined between subgroups of the population, including those defined by the nature and severity of disability. For most groups we find evidence of asymmetry in the impact of onset and exit: employment is significantly reduced at onset and continues to decline post-onset whereas, after controlling for unobserved heterogeneity, exiting disability has a limited effect.

JEL Classification: J10, J20
Keywords: Disability, dynamics, employment, Local Labour Force Survey.

Acknowledgements: This work is based on data from the Annual Population Survey which has been collected by the Office for National Statistics (ONS) and is accessed via special licence from the UK Data Archive, University of Essex, Colchester. The construction of the Local Labour Force Survey Panel was supported by an Economic Research Grant from the Welsh Government. We are grateful to participants at the WPEG conference in the University of Sheffield, departmental seminars at the University of Kent and Nottingham Trent University and Phil Murphy and Peter Sloane for comments on an earlier draft. We would also like to thank three anonymous referees for their comments on the initial submission. None of these individuals or organisations bears any responsibility for the analysis or interpretation undertaken here.

Corresponding author: Professor Melanie Jones, Cardiff Business School, Cardiff University, Aberconway Building, Colum Drive, Cardiff, CF10 3EU. Tel: +44 (0)2920 875079. E-mail: JonesM116@cardiff.ac.uk.

1. Introduction

Unlike many personal characteristics, disability is not always permanent, and by acknowledging and exploring its dynamic patterns researchers have the opportunity to enhance their understanding of the relationship between disability and labour market disadvantage. Existing longitudinal studies, while rare in comparison to those using cross sectional data, have been able to (1) explore the dynamic patterns of self-reported disability (2) apply panel data techniques to more accurately establish the causal impact of disability on labour market outcomes and (3) trace how the disadvantage associated with disability develops depending on the dynamic trajectory of disability (see, for example, Burkhauser and Daly, 1998; Charles, 2003; Jenkins and Rigg, 2004; Gannon, 2005; Mok *et al*., 2008; Meyer and Mok, 2013; Oguzoglu, 2010, 2012a).

This evidence has been heavily influenced by the availability and nature of existing longitudinal data such as the Panel Study of Income Dynamics (PSID) in the US, Household Income and Labour Market Dynamics (HILDA) in Australia and the Socio-Economic Panel (SOEP) in Germany. In the UK, two sources of data have been used in this context, namely the British Household Panel Survey (BHPS) (see, for example, Jenkins and Rigg, 2004) and the Longitudinal Labour Force Survey (LFS) (see, for example, Burchardt, 2003). Researchers have thus faced a trade-off between the length of the panel, which is restricted to one year in the Longitudinal LFS, and sample size. Indeed, in their analysis of 8 waves of the BHPS, Jenkins and Rigg (2004) are only able to identify 280 individuals who experience disability onset (defined as two periods reporting disability after two periods of not reporting). Understanding the dynamic impact of disability in the UK is, however, critical since the impact of disability on employment is well-established and acknowledged to be larger than for other protected groups (National Equality Panel, 2010). This has resulted in a range of high profile legislative and policy change (Jones *et al*., 2006) such as the introduction of the Disability Discrimination Act (1995) (DDA) and reform of the disability benefit system, including the introduction of Employment and Support Allowance.

This paper utilises an unexploited source of longitudinal information for Britain created by matching individuals across time (2004-2010) from the Local Labour Force Survey (LLFS). While extensively used to produce cross-sectional national statistics, to our knowledge this is the first time the longitudinal element of these data, which we refer to as the LLFS panel, have been utilised. These data retain the benefits of the Longitudinal LFS, including a large

sample and comprehensive information relating to demographics and labour market characteristics (see, for example, Frijters *et al*., 2005) but have the additional advantage of an extended (four year) panel element (see Section 2 for details). This extended panel forms an underutilised resource generally but one that has particular benefits for examining (relatively short term) labour market dynamics of minority groups such as those who self-report disability. Indeed, previous evidence in the US has shown the majority of the impact of disability is evident in the period immediately post-onset (Mok *et al*., 2008; Meyer and Mok, 2013) and that subsequently this impact persists.

By applying event-study and panel data methods in a similar manner to Charles (2003) and Meyer and Mok (2013), this paper provides new evidence for Britain on the extent to which labour market outcomes deteriorate at the time of disability onset and how this disadvantage develops post-onset. The particular contribution of this paper is provided through the analysis of the enhanced sample of the LLFS panel, which facilitates a far more detailed consideration of how these effects vary within the disabled group. Following Charles (2003), the role of age at onset and educational attainment are explored but unlike much of the previous evidence, these data also permit consideration of the influence of gender and characteristics of the disability including type and severity. We are therefore able to explore differences in the extent of disadvantage at the onset of disability associated with mental or more severe (multiple) health problems.

In addition, this paper is the first to apply this method to explore the influence of recovery from disability, what is referred to as disability exit, on labour market outcomes. While disability exit is widely recognised as an important feature of the dynamic nature of disability (Burchardt, 2000) far fewer researchers explicitly consider its impact on labour market outcomes (see Disney *et al*., 2006, for an exception in the context of health and retirement) and, to our knowledge, none have applied the current methodology in this context.[1] As such, this paper contributes new evidence on the symmetry, or otherwise, of labour market adjustment associated with disability onset and exit. That is, we explore how the deterioration in outcomes experienced at disability onset differs from improvement at exit.

[1] Gannon and Nolan (2007) examine the influence of disability exit on household income and poverty in Ireland.

We focus primarily on employment as the critical dimension over which labour market disadvantage develops in the UK and which is the focus of government policy (Conservative Party Manifesto 2015).[2] Indeed, cross sectional evidence (Kidd *et al*., 2000; Jones *et al*., 2006) has shown that the employment gap associated with reporting disability (at about 50 percentage points) far exceeds the impact of disability on other labour market indicators such as earnings (10-15%). Further, in longitudinal analysis based on US data, changes in annual income arising from disability onset are found to be primarily driven by changes in hours of work rather than changes in hourly wages (Charles, 2003; Meyer and Mok, 2013).

Our principal findings indicate that disability onset has a significant negative impact on employment (as measured by hours of work) and that this effect widens post-onset. However, after controlling for unobserved heterogeneity, the effect of disability exit is modest and for many groups statistically insignificant, suggesting that the employment impact of onset and exit are asymmetric. The remainder of the paper is structured as follows. Section 2 explains the construction of the LLFS panel and Section 3 introduces the definitions of the key variables in this analysis. Section 4 outlines the statistical methodology applied. Section 5 presents the results and Section 6 briefly concludes.

2. Construction of the LLFS Panel.

Cross sectional versions of the Annual Population Survey (APS) are available from 2004 and contain observations from three sources: the Quarterly LFS (QLFS), the APS boost and the LLFS (see Jones *et al*., 2012, for a detailed discussion). The rotational 5 quarter panel properties of the QLFS are well-established, have led to the production of the Longitudinal LFS by the Office for National Statistics (ONS) but nevertheless remain relatively underutilised (see Frijters *et al*., 2005). Our attention, instead, focuses on the LLFS where information is based on the same survey questions, but, residences are selected for inclusion on the basis of a rotational four year panel, with 25% being replaced each year. While cross-sectional versions of the APS are routinely used to produce national statistics these (extended) longitudinal properties of the LLFS have, until now, largely been overlooked.[3]

[2] We acknowledge that the impact on household income is unlikely to be as pronounced as the employment impact given the UK disability benefit system and the possibilities for reallocation of labour supply within the household.

[3] The APS boost has a similar 4 year panel element but is not included since it only operated in 2004 and 2005.

The LLFS was introduced separately in England (from 2000), Wales (from 2001) and Scotland (from 2003) to enhance the sample of the QLFS and provide more robust information at the local area level. As such, when used alone, as it is here, it is not completely representative of the population of Great Britain. In particular, the LLFS sample over represents individuals living in Wales and Scotland and, while this is reflected in the residential distribution of the sample, it appears to have minimal impact on the composition in terms of personal characteristics (including the prevalence of disability) (see Appendix 1 for details).

We pool observations from the LLFS across the January-December versions of the APS from 2004 to 2010 inclusive and perform a matching exercise across individuals based on the system variables derived during the administration of the LLFS (see Jones *et al*., 2012 for further details).[4] After excluding individuals who are not of working age throughout the panel the total sample is 356,181 individuals. Given our focus on dynamics we further restrict the sample by removing individuals with fewer than 3 consecutive responses. In total we are left with a maximum sample of 71,335 individuals, of which, about half (35,231) provide information at all four waves. The reduction in sample is partly a consequence of the complex patterns of response generated from the rotational panel element of the LLFS and, in particular, the truncation of individual panels resulting from the restricted (2004-2010) coverage of the data available.[5] However, it should be acknowledged that the LFS is not designed as a panel survey and it is the address (rather than the individual) that is traced across time. As a consequence observations in the LLFS panel are restricted to households that did not move address and, individuals who remained resident within these households for at least three (consecutive) years. Our sample therefore excludes individuals who experience disability onset/exit which is associated with selective residential mobility, for example, that which may arise due to access to formal or informal care (Norman *et al*., 2005). As such, it may exclude those with the most severe onset (greatest recovery at exit) and therefore potentially underestimates the impact on labour market outcomes. However, and consistent with younger groups being more mobile (see Finney and Simpson, 2008), attrition increases

[4] Due to the rotational design of the survey (responses being carried forward to subsequent waves), attention is given to ensuring the longitudinal integrity of the LFS. It is therefore imperative that administrative information is collected to enable interviewers to uniquely identify individuals and link responses across time.

[5] Truncation refers to cases where it is not possible to provide 3 or more consecutive responses and would include those who entered the LLFS before 2003 or after 2008. This accounts for roughly 45% of the individuals dropped from the entire LLFS sample.

the prevalence of disability in the LLFS panel (relative to the LLFS cross-section) by about 1 percentage point (or approximately 8%). Moreover, within this group, there is no evidence of a reduction in severity (as proxied by multiple health problems), albeit there is a slightly higher prevalence of physical health problems (see Appendix 1 for details).

3. Definition and Construction of Key Variables

Employment is measured using the International Labour Organisation (ILO) definition and three measures are utilised to capture adjustment at the extensive and intensive margins. First, a binary measure is used to indicate current employment status, where employment includes both paid and self-employment and non-employment is defined to include unemployment and inactivity. This is used to identify the impact of disability onset on exiting work, which is consistent with the focus of the existing UK literature (Jenkins and Rigg, 2004), especially the literature on health and retirement (Disney *et al*., 2006). Second, for those in employment, information on basic usual weekly hours in the main job is used to capture changes in hours among those who retain work (see Jones, 2007) and therefore an element of workplace adjustment under the principles of DDA.[6] Third, following US studies such as Charles (2003) and Meyer and Mok (2013), we combine these two pieces of information to generate a measure of employment, where the non-employed are classified as working zero hours so that weekly hours of work are defined for the entire population. We acknowledge that this measure aggregates across, what are likely to be, two distinct decisions but argue that, by capturing both margins, it provides a more comprehensive measure of employment adjustment. In the LFS, information on hours is reported to the nearest integer (up to a maximum of 97) and the mean value is 34.5 for those in work and 26.1 after including the non-employed. For those who retain work, who we recognise are unlikely to be representative of those who experience disability onset, we also explore the impact of disability on hourly earnings. Our measure of hourly earnings is used as a proxy for productivity and in-work adjustment (see Charles, 2003) and is derived from gross weekly pay divided by usual hours (which may include overtime). Outliers are removed following the LFS recommended filter which restricts nominal values to lie between £0 and £100. These are deflated to 2005 prices using the retail price index.

[6] The results are qualitatively similar (but of slightly larger magnitude) using total usual hours (including usual overtime).

The LFS contains DDA and work-limiting (WL) measures of disability, where the former is defined as someone who has a 'physical or mental impairment that has a substantial and long-term adverse effect on his or her ability to carry out normal day-to-day activities'. We perform our analysis on both these measures separately but for simplicity and consistency with existing longitudinal evidence (see, for example, Charles, 2003) we only present results relating to the WL measure.[7,8] Individuals are defined as WL disabled if they report a long-term health problem which restricts either the amount or kind of work they might do (see Jones *et al*., 2006 for details); all other individuals form the non-disabled group. While there are well-established limitations of using self-reported information on disability for labour market analysis including measurement error and justification bias (Bound, 1991) conclusions from the existing evidence are mixed. Previous studies (see, for example, Stephens, 2001) argue in favour of using such measures on the grounds that the two opposing biases act to offset each other.[9] There are at least two advantages of longitudinal data in this respect (see Charles, 2003). First, the ability to control for unobservable time invariant factors which may be correlated with disability reporting and second, the focus on consistent patterns of reporting over time which may reveal a more accurate measure than those based on a single observation. Further, given the dynamic nature of the analysis we are able to exploit the timing of onset relative to changes in employment to identify causality (see Section 4).

Unlike Charles (2003) and Meyer and Mok (2013) who use data from the PSID, the LLFS does not contain retrospective information on the date of disability onset. Instead, we focus on disability transitions within the panel and, as such, our analysis, in a similar manner to

[7] There is a substantial overlap between these measures with 72% of DDA disabled individuals also WL disabled and 81% of WL disabled individuals also DDA disabled. There are nevertheless arguments for and against each measure, with some authors preferring the activity limiting measure since it is directly related to the protection provided by legislation and is less likely to be affected by justification bias (Oguzoglu, 2012b). A greater proportion of individuals (29%) are found to have dynamic patterns which include disability when using the DDA definition but results from the event-study analysis are qualitatively similar. As may be expected given the broader nature of the measure and its less direct relationship with work, the onset effects of DDA disability are considerably smaller in magnitude (8 percentage points or 3.0 hours by t^*+2).

[8] The ONS has recently highlighted a discontinuity in the measures of disability in the LFS between 2009 and 2010. This relates to a minor change in the administration of the questionnaire where "*I should now like to ask you a few questions about your health. These questions will help us estimate the number of people in the country who have health problems*" was added to the survey. It is, however, thought to have increased the prevalence of disability by about 1.5 percentage points. We therefore explore the robustness of our findings to excluding potentially affected individuals from our sample. The composition of the dynamic trajectories and our conclusions with respect to the main results are all unchanged.

[9] The LLFS does not contain more objective measures of health from which these issues can be explored directly (see Disney *et al*., 2006). It is, however, reassuring that there is a degree of consistency in self-reporting disability and receipt of sickness/disability benefits since the latter have more objective criteria and, in some instances, involve an external medical assessment. For example, 42% of disabled individuals report receiving sickness/disability benefit compared to 1% of the non-disabled.

Jenkins and Rigg (2004) and Burchardt (2003), does not necessarily relate to the first disability transition over the lifecycle.[10] As a consequence we are, however, able to consider transitions in the 'current' economic and policy environment. Given this period includes (from 2008) a severe downturn in the economy we also perform analysis for separate samples based on their year of entry into panel. The results are, however, largely unchanged.

Chronicity captures a dimension of severity and Charles (2003) distinguishes between three post-onset disability trajectories, namely, those that always report disability after onset; never report disability again after onset and other patterns. Meyer and Mok (2013) similarly distinguish between the following spells: one period disability (single report), temporary disability (two or fewer positive reports post-onset) and chronic disability (three or more positive reports post-onset). Given our focus on transitions within the panel we adopt a classification developed by Kapteyn *et al*. (2008) and applied subsequently by Oguzoglu (2010) which distinguishes between 'consistent' and 'irregular' patterns of reporting. We separate the sample into the following five exhaustive and mutually exclusive disability trajectories which, unlike the above papers, explicitly separates and considers disability exit:[11]

- Continuously disabled (disabled at each interview)
- Continuously non-disabled (non-disabled at each interview)
- Consistent disability onset (non-disabled every interview pre-onset and disabled every interview post-onset)
- Consistent disability exit (disabled every interview pre-exit and non-disabled every interview post-exit)
- All other patterns are referred to as irregular (such as non-disabled, disabled, non-disabled).

The first two groups are self-explanatory and while retained within our sample are not important in identifying the dynamic influence of disability. Individuals in the other three groups all experience a disability transition as defined as one period of non-reporting

[10] Charles (2003) notes the similarities between disabled individuals identified using retrospective information and reporting disability after two consecutive periods of non-reporting.

[11] As with all longitudinal information, response error or misclassification resulting from individual or interviewer errors may give rise to spurious transitions but there is no way of investigating this issue further here. Again, however, transitions in sickness/disability benefit receipt provide some reassurance. About half of those who report being continuously disabled also continuously report receipt of sickness/disability benefits whereas the corresponding figure for those continuously non-disabled is less than 1%.

disability followed by one period reporting disability (or vice versa).[12] Those with consistent patterns are observed to be in the same state for all periods before and after the transition and, given the potential measurement error in self-reported disability, may thus provide the most reliable indicator of a transition. Nevertheless, we recognise that there may be misclassification between the dynamic trajectories and the consistent onset/exit and irregular groups in particular. We focus on consistent onset and exit, where individuals are seen to make a 'permanent' transition and changes in outcomes post-onset can therefore be interpreted as the influence of additional years of disability (or duration).[13] However, since the data are right and left censored this interpretation is constrained to be *within* the panel and does not provide any indication of the permanency of disability across the lifecycle and/or subsequent transitions. Indeed, in what follows we focus on disadvantage associated with consistent onset/exit relative to the period prior to onset/exit and aggregate across individuals who may go on to experience different durations of disability (or non-disability).[14] Since this type of dynamic classification is, by definition, sensitive to the length of the panel element it limits the direct comparability with previous studies. Given the unbalanced nature of our sample we nevertheless explore differences in the trajectories between those present for 3 or 4 waves.

We also consider how the dynamic influence of disability varies by personal characteristics including gender, age and education level, and aspects of the disability itself particularly severity and type. The latter, in particular, is highlighted as important but is not considered in previous analysis (Charles, 2003; Meyer and Mok, 2013). In terms of the age we distinguish between two broad but similar sized groups, those aged 16-45 (younger) and 45-65 (older) respectively.[15] Similarly for educational attainment we include highest qualifications up to and including those associated with the completion of compulsory schooling (GCSE level) in the low qualifications group and everything above this in the high qualification group. Education can be thought of a proxy for the incentive to remain within the labour market but

[12] We also experimented with the definition of Charles (2003) where onset is defined as two periods of non-reporting followed by at least one period reporting disability and the corresponding definition is used for exit. The percentage of individuals in the consistent onset (exit) groups drop from 5.03 (4.85) to 3.47 (1.68) and the window for the analysis is shortened to one year post-onset/exit. The key results are, however, unchanged.
[13] We explore the impact of more complex irregular trajectories of disability and find evidence of a negative but more modest disability onset effect. These results are available on request.
[14] Within the consistent onset (exit) group there is heterogeneity in duration as individuals experience disability onset (exit) at different points within their panel. Additional analysis which explores the impact of duration is available on request.
[15] The patterns are qualitatively similar if instead the younger group is defined as aged 25-45.

may also reflect occupation, job demands and hence opportunities for in-work adjustment. Individuals who report a long-term health problem are also asked to record *each* of their health problems. This information is used to distinguish between those who report physical, mental or both physical and mental health conditions.[16] Among those who report physical *or* mental health problems the presence of multiple health problems (see Appendix 2 for details) is used as an indicator of severity. We acknowledge it is an imperfect measure since it assumes multiple separate health problems are more serious than any single condition but has previously been shown to be related to subjective measures of severity (Berthoud, 2003). In defining these groups we measure personal characteristics at the first point of contact and disability related characteristics at the first point of disability reporting; further examination suggests transitions in type and severity across the duration of disability are limited.[17]

The composition of the sample in each of the dynamic disability trajectories is provided, by gender, age and educational attainment, in Table 1. While about 25% of the overall sample report disability at some point during the panel less than 10% are continuously disabled, confirming the importance of dynamic patterns of disability (Burchardt, 2000; Burchardt, 2003). It is particularly important to note the prevalence of consistent disability exit: there is roughly equal representation of consistent onset, consistent exit and irregular patterns. The disability trajectories are similar for males and females but, consistent with previous evidence, individuals who are older and hold fewer formal qualifications are less likely to be continuously non-disabled and are more likely to be continuously disabled. Rates of consistent onset and exit are also higher among the older group and, to a lesser extent, among those with low qualifications. The prevalence of consistent onset and exit is not, however, sensitive to whether an individual reports three or four waves of data.[18]

[16] Individuals are asked to indicate the nature of their health problem(s) from a list of 17 possible responses (see Appendix 2). Mental health problems are defined here to include *depression, bad nerves, anxiety; severe or specific learning difficulties; mental illness, phobia, panics or other nervous disorders.*

[17] About 95% of disabled respondents report the same broad type of main health problem throughout the panel and 86% would be classified in the same severity group (single or multiple) on the basis of the first and average number of health problems. In terms of the fivefold type-severity classification 66% remain in the same group throughout their panel.

[18] Those who provide data for all four waves are, however, more likely to report irregular patterns (and less likely to continuously report being non-disabled). We further explore the sensitivity of our estimates to restricting the sample to those with 4 waves of data and find the key patterns are qualitatively unchanged. These results are available on request.

Table 2 provides descriptive statistics relating to the characteristics of disability and labour market outcomes measured in wave 1 for those with different disability trajectories.[19] The majority of disabled individuals report physical health problems, although respondents with multiple health problems and particularly physical and mental health problems make up a greater proportion of those continuously disabled than the other disability trajectories. Those who consistently exit disability are less likely to report multiple health problems, in line with these being a proxy for severity. The analysis confirms the stark contrast in employment status between those continually disabled and non-disabled (61 percentage points or 22.4 hours a week) and, albeit the more modest, difference in hours and hourly earnings for those in work (4.3 hours and £2.20). The employment rate is also lower (even during the first wave) for all the disability trajectories including consistent onset who by definition do not report disability at this point. This provides confirmation of a selection effect (Jenkins and Rigg, 2004), that is, those at risk of reporting disability but who subsequently do not have higher employment rates than those who experience onset. However, a larger selection effect appears to operate in terms of disability exit. Those with consistent exit, who by definition are disabled in wave 1, have an employment rate of 67% compared to 23% among those who are continuously disabled (that is, those at risk of exit, but who do not).

4. Statistical Methodology

Following Charles (2003) and Meyer and Mok (2013), but accounting for the shorter length of the LLFS panel and explicitly considering disability exit, we model each labour market outcome as follows:[20]

$$E_{it} = \alpha_i + \gamma_t + X_{it}\beta + \sum_g \sum_k \delta_k^g A_{kit}^g + \sum_r \sum_h \varphi_h^r F_{hit}^r + \varepsilon_{it} \quad (1)$$

E_{it} primarily refers to employment for individual i at year t, as measured using the three variables outlined in Section 3, although hourly earnings are also considered. Time period (year) fixed effects are captured by γ_t and personal and household characteristics (X_{it}) include controls for time varying characteristics such as age and age squared, mode of interview, highest educational qualifications, full-time students, marital status and dependent

[19] Employment rates are traced before and after onset (exit) in Figure 1(a) (1(b)).
[20] Following Singleton (2012) and Disney *et al*. (2006) a linear probability model is used for the binary measure of employment for ease of interpretation. The results from a conditional logit model are, however, qualitatively similar.

children within the household. A_{kit}^{g} is a dummy variable which equals 1 if in year *t* individual *i* belongs to onset group *g* and he/she is *k* years from onset (*t**) (a minus indicates prior to onset). Despite each individual being in the panel for a maximum of 4 years, differences in the timing of onset between individuals give rise to a maximum 6 year 'window' (3 years pre-onset (*t**-3) to 2 years post-onset (*t**+2)) over which the dynamic effects of disability can be traced.[21] The effect of onset is measured relative to the omitted group (three years pre-onset) $k \in (-2,2)$.

Since the model is estimated with individual fixed effects, δ_k^g measures the impact of disability *k* years away from onset for those in disability group *g* relative to that 3 years pre-onset. The inclusion of fixed effects removes all time invariant influences including factors such as stable personality traits and motivation and means that, unlike in cross sectional analysis, estimates are not biased by the presence of unobserved differences between those who do and do not report disability. F_{hit}^{r} is constructed in a similar manner but relates to exit group *r* when he/she is *h* years from exit (*t`*). Again there is a maximum window of 3 years pre-exit to 2 years post-exit and the effects are measured relative to 3 years pre-exit $h \in (-2,2)$. The impact of disability on hours of work *h* years away from exit for those in disability group *r* relative to that 3 years pre-exit is given by φ_h^r. Since individual error terms are likely to be correlated we report standard errors which allow for clustering at the level of the individual to account for serial correlation and heteroscedasticity. Initially equation (1) is estimated where the influence of consistent onset/exit is estimated across the sample, subsequently versions allow the impact of onset (exit) to vary by group *g* (*r*) where these are defined by the personal and disability related characteristics outlined above.

There have been a number of applications of this technique in the context of disability including to the analysis of hours of work (Charles, 2003; Mok *et al*., 2008; Meyer and Mok, 2013), income (Charles, 2003; Mok *et al*., 2008; Meyer and Mok, 2013), consumption (Stephens, 2001; Meyer and Mok, 2013), marital status (Singleton, 2012) and life satisfaction (Powdthavee, 2009; Pagán, 2010; Pagán 2012). As Charles (2003) notes the approach has

[21] The 6 year window arises because individuals experience disability onset at different waves within the panel element. For example, labour market status of an individual who experiences disability onset in wave 2 (early within their panel) could be observable between *t**-1 and *t**+2. The labour market status of an individual who experiences disability onset in wave 4 (at the end of their time in the panel) could be available between *t**-3 and *t**. As a consequence the sample of respondents varies between periods *t**-3 and *t**+2 since individuals cannot be observed at each of these points. The corresponding arguments apply in the analysis of disability exit.

two key advantages including (1) explicit consideration of the dynamic accumulation of disadvantage associated with disability (2) the ability to control for individual specific time invariant unobservable factors which determine employment and which may bias cross sectional estimates.[22,23] Time varying unobservables correlated with both disability transitions and labour market outcomes remain a potential bias. For example, an employment shock that simultaneously causes an individual to report disability will overestimate the impact of disability onset. Reassuringly, however, after controlling for unobserved heterogeneity we find no evidence of significant changes in employment pre-disability onset which provides evidence against reverse causality or justification bias, and is consistent with Meyer and Mok (2013) who find changes in health, but not employment, precede disability onset.[24]

5. Results

Figures 1(a) ((b)) present the percentage change in each of the measures of employment and hourly earnings through disability onset (exit) for those who experience consistent onset (exit). As noted above the sample of respondents varies between t^*-3 and t^*+2 and, as such, compositional differences between 'early' and 'late' transitions potentially influence these descriptive results. Indeed, due to the censoring of the panel we do not observe t^*+2 for all those in t^*+1, as such, the change between t^*+1 and t^*+2 may be affected by selection of the most employable individuals out of disability. Returning to Figure 1(a), there is a gradual decline in the probability of employment and average hours of work, which are significantly lower in t^*-1 than in t^*-3, although the rate of the decline increases towards t^*. The largest decline in employment occurs during the first year post-onset and employment continues to decline, consistent with what Jenkins and Rigg (2004) refer to as a duration effect. In t^*+2 the probability of employment (average hours) has fallen by 40% (47%) relative to that in t^*-3. For those who remain in work an adjustment in hours is also evident although, as may be

[22] The main alternative method to examine the impact of disability onset or receipt of disability benefits on labour market outcomes using longitudinal data has been propensity score matching or difference-in-difference propensity score matching where the impact is assessed relative to a control group (see, for example, Von Wachter *et al*., 2011 and Polidano and Vu, 2015).

[23] The analysis of earnings or hours conditional on work may be affected by the non-random selection of individuals into work. Unobservable time invariant influences on selection can be accounted for by the inclusion of fixed effects but time varying influences potentially bias the results. In analysis of the influence of disability onset on annual and hourly earnings Charles (2003), however, finds no evidence of a selection effect when applying a Heckman correction method. Given our focus on employment we acknowledge, but do not further investigate, the issue of sample selection bias on earnings and hours conditional on work.

[24] We are unable to rule out the influence of shocks that have simultaneous effects on disability and employment or bias arising from those who may report disability in anticipation of adverse *future* labour market outcomes.

expected, it is more modest (-11% by t^*+2) and occurs entirely post-onset. The decline in average hourly earnings (-6% by t^*+2) is even less pronounced.

Employment increases significantly and substantially before disability exit (Figure 1(b)) suggesting that for many employment adjustment precedes disability exit. Indeed, the largest percentage gain is experienced between t`-2 and $t$`-1. The impact of exit between t`-1 and $t$` is modest and suggests that, relative to onset, disability exit and employment are less closely related in timing. There is a continuation of the gradual upward trend in the years following disability exit. Over the entire period the percentage change in employment (hours) for those who exit is substantial at 67% (76%) of the t`-3 value. In-work adjustment is more modest, the change in hours (6%) occurs entirely pre-exit and, the change in average hourly earnings (3%) is only evident post-exit. The absolute change in employment associated with disability onset (32 percentage points or 12.6 hours) is of a comparable magnitude to that at disability exit (32 percentage points or 11.5 hours). At first sight this suggests a remarkable symmetry, however, the majority of the reduction in employment is experienced post-onset (18 percentage points or 7.1 hours), whereas the majority of the gains are experienced pre-exit (20 percentage points or 8.1 hours). These figures, however, simply reflect averages and, therefore, as noted above may be sensitive to changes in the composition of the sample.

Table 3 presents the coefficient estimates from the fixed effects model described by equation (1) which controls for observable time varying characteristics and individual unobserved heterogeneity. The results are presented in column (2) for employment status, in (4) for hours of work defined to include the non-employed, in (6) for hours of work among the employed, and in (8) for (the log of) hourly earnings.[25] To facilitate a comparison across specifications the percentage change relative to t^*-3 or t`-3 is also reported (where appropriate). After controlling for fixed effects, disability onset is associated with a 7 percentage point fall in the probability of employment at t^* (relative to t^*-3) and, unlike the descriptive evidence, there is no significant decline in employment before this point. This is consistent with there being no anticipation effects or that, for most, onset being relatively sudden. As noted above, it also suggests the direction of causality runs from changes in disability to employment rather than vice versa. In contrast to arguments and evidence of adaption in the context of subjective

[25] We also performed the analysis on hours of work and hourly earnings among those who remain employed throughout the panel but the results are similar, albeit of smaller magnitude. Further, these results are not sensitive to the inclusion of additional employment-related control variables (industry, occupation, tenure).

wellbeing (Powdthavee, 2009; Pagán, 2010), employment disadvantage accumulates with the duration of disability, at least over the period considered here. The probability of employment continues to decline and the gap reaches 17 percentage points (or 21%) by t^*+2. Given the measure of hours of work in column 2 includes changes in employment status and changes in hours among those in work (see below), it is unsurprising that the impact of disability onset is slightly more pronounced: the decline reaches 6.3 hours in t^*+2 (a 23% reduction relative to t^*-3). Relative to the descriptive statistics the multivariate analysis presents a significant but more modest impact of disability consistent with the inclusion of controls for employment determining characteristics (particularly individual fixed effects).

The adjustment in hours for those who remain in employment (column 6) follows a similar pattern, although, as may be expected, the magnitude is smaller confirming the majority of change in employment occurs at the extensive margin or that the particular risk for individuals who become disabled is in terms of *job loss*. Indeed, the impact of disability onset is only significant at t^*+1 where there is about a 1 hour (3%) reduction in weekly hours for those who remain in work. Hourly earnings (column 4) are found to decline with disability onset, although the impact is modest (6% in t^*+1), consistent with a more limited impact on in-work outcomes.

The lower panel of Table 3 presents the corresponding influence of disability exit. There is evidence that the probability of employment increases at exit and this appears to persist post-exit but the magnitude of the effect is smaller than at onset. Indeed, there is no significant influence of exit on hours either generally or for those in work, or on hourly earnings.[26] This contrasts sharply with the descriptive evidence and suggests that other employment determining characteristics of individuals who exit disability rather than exiting disability itself are the cause of employment gains.

In Table 4 the impact on employment is allowed to vary by gender (columns 2 and 3), age (columns 4 and 5) and qualifications (columns 6 and 7). For ease of comparison, the coefficients are also presented graphically in Appendix 3 (Figures A1-A3). For simplicity we present results on the basis of hours of employment but note that the patterns are similar if, instead, the probability of employment is considered. The influence of disability onset

[26] Given the sample is constrained to those resident at the same address across time this analysis will exclude any increase in employment at disability exit which is associated with relocation.

follows a similar pattern by gender although the magnitude of the onset effect and the subsequent influence post-onset is greater for men. In t^*+2 men work 9.1 hours less than in t^*-3 compared to 3.9 hours for women. Proportionately this reflects a greater loss for men (28%) than women (18%) and highlights the importance of considering gender in analysis of this type. Such differences may, in part, reflect differences in the nature of employment that give rise to variation in the opportunities to accommodate disability in work.[27]

The impact of onset also differs considerably by age, older individuals experience a steeper decline in hours both at onset and post-onset. This is consistent with US evidence and the disability human capital framework (Charles, 2003) which predicts that individuals who are older at onset will lose more 'healthy' human capital and have less incentive to acquire 'disability' human capital.[28] It is also consistent with arguments that disability, and particularly receipt of disability benefits, have been a route into early retirement (Disney *et al*., 2006). For younger individuals there is an initial increase in hours prior to onset and (relative to t^*-3) the impact of disability onset is not significant until t^*+1 where there is an overall loss of 2.9 hours. Possibly surprisingly the absolute impact of disability does not differ dramatically by educational attainment with a relatively similar profile between the low and high qualification groups. Indeed, there is no significant difference in the onset coefficients between education groups suggesting that while education reduces the risk of disability onset it does not insulate individuals from its adverse employment consequences.[29] This is also true when examining the influence of education within the older group (results not reported).

While it is not appropriate to make a direct comparison between these results and those in Mok *et al*. (2008) or Meyer and Mok (2013) given the methodological differences involved a rough annual (48 week) conversion of the estimated loss in weekly hours suggests that about 302 hours are 'lost' two years post-onset and that the figure is higher for males at 437.

[27] In subsequent analysis by occupation (or previous occupation) it is individuals in physical occupations, namely, skilled trades and process, plant and machine operatives, which report the largest reduction in hours at onset. However, since this analysis can only be performed on a subset of individuals where such information is available these results are not presented in full.

[28] The magnitude of the estimates in Charles (2003) were however later questioned by Mok *et al*. (2008). There is also evidence that onset among the older group is more severe, in that, it is more likely to be associated with multiple health problems but the effect of age is evident both for individuals with single and multiple health problems (results not reported).

[29] However, having a higher level of education does provide protection from earnings losses at onset which are confined to the low education group (results not reported but available on request).

Unsurprisingly, this is lower than the estimates for the most severely disabled workers in Mok *et al*. (2008) or Meyer and Mok (2013) but, in terms of the latter, our estimates are comparable to those for an aggregate measure of disability onset (-346).

Consistent with the results in Table 3 there is limited evidence that disability exit increases employment. There are, however, two exceptions (1) women experience a small (1.8 hour) increase in hours by *t'*+2 and (2) individuals with low qualifications experience an increase of 2.0 hours by *t'*+2. It is perhaps surprising given the potential (but unobserved) difference in duration of disability that the influence of exit is similar for the older and younger groups. The absence of an influence of disability exit is consistent with the impact of disability persisting possibly as a consequence of lasting change in preferences for work or through a permanent change in productivity, arising for example, from deterioration in human capital and/or work habit as a result of a period away from the labour market. Indeed, this is in accordance with international evidence from Gannon (2005) and Oguzoglu (2010) who, when estimating a dynamic panel model of labour market participation, find that past participation is related to current participation even after accounting for past disability and that these controls dampen the influence of current disability. In this context it is, however, important to recall the selection effect noted above. Individuals who exit disability are more likely to be employed in *t'*-3 than those who remain disabled which may suggest that, for these individuals the impact of onset was more modest or, that employment adjustment is more gradual and occurs prior to the period observed here.

In Table 5 (and Appendix 3 Figure A4) we consider the influence of the characteristics of disability itself.[30] The patterns of onset are qualitatively similar across the five groups. The reduction in hours at onset is, however, more pronounced for mental compared to physical health problems, consistent with the larger employment gap identified for mental health problems in cross sectional analysis. For those with physical health problems the presence of multiple health problems has a more pronounced impact than a single health. For those with mental health problems only, albeit the sample size is small, there appears to be less distinction between the onset of single versus multiple health problems with the coefficients insignificantly different from each other, and possibly reflects the difficulty in capturing the

[30] We further experimented with a more detailed classification of severity which distinguishes between 1, 2, 3 and 4 or more separate health problems and an interaction between multiple health problems and the type of *main* health problem. The main results are robust to this change.

severity of mental health problems in this way. Further, while the impact of multiple mental health problems does not appear to widen post-onset the impact of multiple physical and physical and mental health problems becomes more pronounced with a reduction in 10.7 hours among the latter by t^*+2. Interestingly, however, it is only exiting disability associated with both physical and mental health problems that is associated with a significant increase in hours of work (4.3 hours by t'+2).

6. Conclusions.

In undertaking analysis of the dynamic impact of disability on labour market outcomes researchers in the UK have faced a trade-off between the length of the panel and sample size. By using the extended panel element of the LLFS, created by matching individuals from cross sectional data, this paper aims to provide evidence based on a large sample over a longer (3-4 year) period. This facilitates a dynamic analysis of the relationship between work-limiting disability and labour market outcomes which is able to consider subgroups as defined by gender, age and education and by the characteristics of the disability itself including severity and type. In doing so, it provides new longitudinal evidence for Britain and provides an important comparison to the existing applications of this technique typically based on US data.

The analysis confirms that the onset of work-limiting disability is associated with significant labour market disadvantage in Britain between 2004-2010, consistent with previous evidence in the UK (Burchardt, 2003; Jenkins and Rigg, 2004) and US (Mok *et al*., 2008; Meyer and Mok, 2013). The effects predominately operate through individuals changing employment status, although this is reinforced by a reduction in hours and hourly earnings for those who retain work. Where the pattern of onset is consistent the employment effect is cumulative, becoming significant at onset for most groups and subsequently widening, which accords with a disability duration effect. Over the 6 year window considered here (3 years prior to 2 years post-onset) average weekly hours of work fall by 6.3 or 23%. However, the impact of disability onset varies considerably between groups of individuals particularly by age and gender consistent with a differential risk of job loss at disability onset. The impact of is more modest for females and younger individuals, and the gradient of the post-onset loss in hours is also shallower. Indeed, two years after onset the average loss in hours for females (or individuals aged below 45) is less than 50% of that for males (individuals aged above 45). The impact of onset is also greater for those with mental relative to physical health problems,

and among the latter, is exacerbated by the presence of multiple conditions. This is consistent with heterogeneity in the disability itself being important and suggests a need for a tailored policy response.

This paper also considers disability exit which, despite its prevalence in survey data, has received far less attention in the existing literature. The evidence based on the sample of individuals who exit disability over the panel, suggests the impact of disability exit on hours of work, after accounting for individual fixed effects, is typically limited, being statistically insignificant for many of the groups. While surprising, it is consistent with the absence of a recovery in hours of work for those who do not permanently report disability post-onset (Mok *et al*., 2008) and may suggest a scarring effect whereby current labour market outcomes are adversely affected by *past* disability. Disability exit is, however, a significant positive determinant of hours for females, those with low qualifications and for those who simultaneously report mental and physical health problems.

Nevertheless, the comparison of the impact of disability onset and exit trajectories suggests that the influence is asymmetric. While it is not possible to establish the precise reasons for this, it has important implications for policy. The pronounced impact of onset suggests resources should be targeted at reducing the risk of disability onset and/or supporting individuals retain work at this time. The latter is aligned to increasing recognition that the welfare system tends to support disabled people who are unable to work rather than in order to *maintain* work. This may require support for employers as well as employees, for example, in the identification and development of effective workplace adaptations, and is consistent with recent government policy initiatives such as 'Fit for Work' through which employers can access free advice and guidance from occupational health professionals, refer employees for a work-related health assessment and claim tax relief on medical treatments which aid an employee's return to work. Gregg and Gardiner (2016) have, however, argued that there is a need for more comprehensive protection, through for example, the introduction of a one year statutory right to return to work after sickness absence.

In terms of exit, the key insights seem to be in terms of selection and adjustment pre-exit, that is, employment appears to be part of the process that occurs prior to, rather than a consequence of, disability exit. Given the nature of our results, and the prevalence of disability exit in survey data, we encourage future research to consider the relationship

between exit and disadvantage further to assess the extent to which these findings can be generalised. The availability of a longer panel, in particular, would facilitate the analysis of onset and exit for the *same* individual and would enable fuller consideration of the asymmetry between onset and exit effects, the influence of the duration of disability and role of selection into disability exit.

Using these data it has not been possible to investigate the dynamic patterns of disability over the lifecycle or longer-term response to disability onset or exit. However, previous evidence relating to disability onset suggests the period immediately surrounding onset captures the majority of the adjustment in hours (see, for example, Charles, 2003). In this respect our analysis provides a useful contrast to analysis based on a long (but narrower) panel element and highlights the potential of data with a shorter panel element. Here, we trade off the length of the panel for enhanced sample size (width) to facilitate a robust analysis of subgroups and it may be possible to exploit this aspect of these data in the future to explore a range of more specific issues such as those relating to in-work adjustment to disability. Further, given, to our knowledge, this is the first exploration of the panel element of these data the implications of sample composition, complex patterns of response and attrition are largely unknown. As such, there seems to be value in further analysis, possibly by ONS, to more fully interrogate its properties and formalise its usage. The potential benefits of future research based on these data appear to be large relative to these additional costs.

References

Berthoud, R. (2003) 'Disabled people and jobs', *Benefits*, 11, 163-168.

Bound, J. (1991) 'Self-reported versus objective measures of health in retirement models', *Journal of Human Resources,* 26(1), 106-138.

Burchardt, T. (2000) 'The dynamics of being disabled', *Journal of Social Policy*, 29(4), 645-668.

Burchardt, T. (2003) *Employment retention and the onset of sickness or disability: evidence from Labour Force Survey Longitudinal Datasets,* Department for Work and Pensions In House Report No. 109, London.

Burkhauser, R. and Daly, M. (1998) 'Disability and work: the experiences of American and German men', *Federal Reserve Bank of San Francisco Economic Review*, 2, 17-29.

Charles, K. K. (2003) 'The longitudinal structure of earnings losses among work-limited disabled workers', *Journal of Human Resources*, 38(3), 618-646.

Disney, R., Emmerson, C. and Wakefield, M. (2006) 'Ill health and retirement in Britain: a panel data based analysis', *Journal of Health Economics*, 25(4), 621-649.

Finney, N. and Simpson, L. (2008) 'Internal migration and ethnic groups: evidence for Britain from the 2001 Census', *Population, Space and Place*, 14(2), 63-83.

Frijters, P., Sheilds, M. and Wheatley Price, S. (2005) 'Job search methods and their success: a comparison of immigrants and natives in the UK', *The Economic Journal*, 115, F359-F376.

Gannon, B. (2005) 'A dynamic analysis of disability and labour force participation in Ireland 1995-2000', *Health Economics*, 14(9), 925-938.

Gannon, B. and Nolan, B. (2007) 'The impact of disability transitions on social inclusion', *Social Science and Medicine*, 64(7), 1425-1437.

Gregg, P. and Gardiner, L. (2016) *The road to full employment: what the journey looks like and how to make progress*, Resolution Foundation Report, March 2016.

Jenkins, S. P. and Rigg, J. A. (2004). 'Disability and disadvantage: selection, onset, and duration effects', *Journal of Social Policy*, 33(3), 479-501.

Jones, M. K. (2007). 'Does part-time employment provide a way of accommodating a disability?' *The Manchester School*, 75(6), 695-716.

Jones, M. K., Davies, R. and Drinkwater, S. (2012) *Unlocking the potential of the Welsh Local Labour Force Survey: An investigation into labour market transitions in Wales*, Report for the Economic Research Unit of the Welsh Government.

Jones, M. K., Latreille, P. L. and Sloane, P. J. (2006) 'Disability, gender and the British labour market', *Oxford Economic Papers*, 58(3), 407-449.

Kapteyn, A., Smith, J. P. and van Soest, A. (2008) 'Dynamics of work disability and pain', *Journal of Health Economics*, 27(2), 469-509.

Kidd, M.P., Sloane, P. J. and Ferko, I. (2000) 'Disability and the labour market: an analysis of British males', *Journal of Health Economics*, 19(6), 961-981.

Meyer, B. D. and Mok, W. K. C. (2013) 'Disability, earnings, income and consumption', NBER Working Paper No. 18869.

Mok, W. K. C., Meyer, B. D., Charles, K. K. and Achen, A. C. (2008) 'A note on "The Longitudinal Structure of Earnings Losses among Work-Limited Disabled Workers"', *Journal of Human Resources*, 43(3), 721-728.

National Equality Panel (2010) *An Anatomy of Economic Inequality in the UK*, London: Government Equalities Office.

Norman, P., Boyle, P. and Rees, P. (2005) 'Selective migration, health and deprivation: a longitudinal analysis', *Social Science and Medicine*, 60(12), 2755-2771.

Oguzoglu, U. (2010) 'Dynamics of work limitation and work in Australia'. *Health Economics*, 19(6), 656-669.

Oguzoglu, U. (2012a) 'Dynamics of disability and work in Canada', IZA Discussion Paper No. 6603.

Oguzoglu, U. (2012b) 'Is there a better measure of self-assessed disability?' *Applied Economics Letters*, 19, 1335-1338.

Pagán, R. (2010) 'Onset of disability and life satisfaction: Evidence from the German Socio-Economic Panel', *European Journal of Health Economics*, 11(5), 471-485.

Pagán, R. (2012) 'Longitudinal analysis of the domains of satisfaction before and after disability: Evidence from the German Socio-Economic Panel', *Social Indicators Research*, 108(3), 365-385.

Polidano, C. and Vu, H. (2015) 'Differential labour market impacts from disability onset', *Health Economics*, 24(3), 302–317.

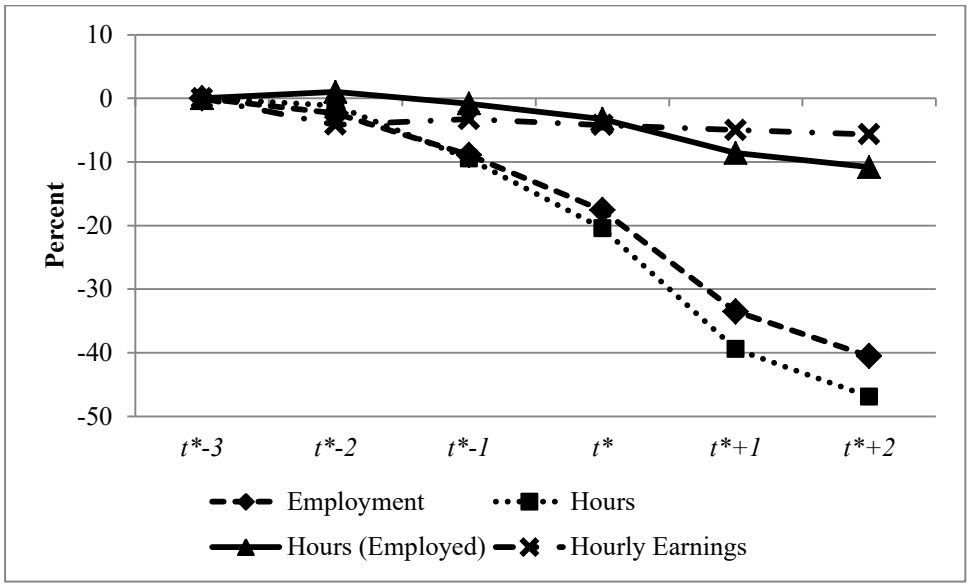
Powdthavee, N. (2009) 'What happens to people before and after disability? Focusing effects, lead effects and adaptation in different areas of life', *Social Science and Medicine*, 69(12), 1834-1844.

Singleton, P. (2012) 'Insult to injury: disability, earnings, and divorce', *Journal of Human Resources*, 47(4), 972-990.

Stephens, M. (2001) 'The long-run consumption effects of earnings shocks', *Review of Economics and Statistics*, 83(1), 28-36.

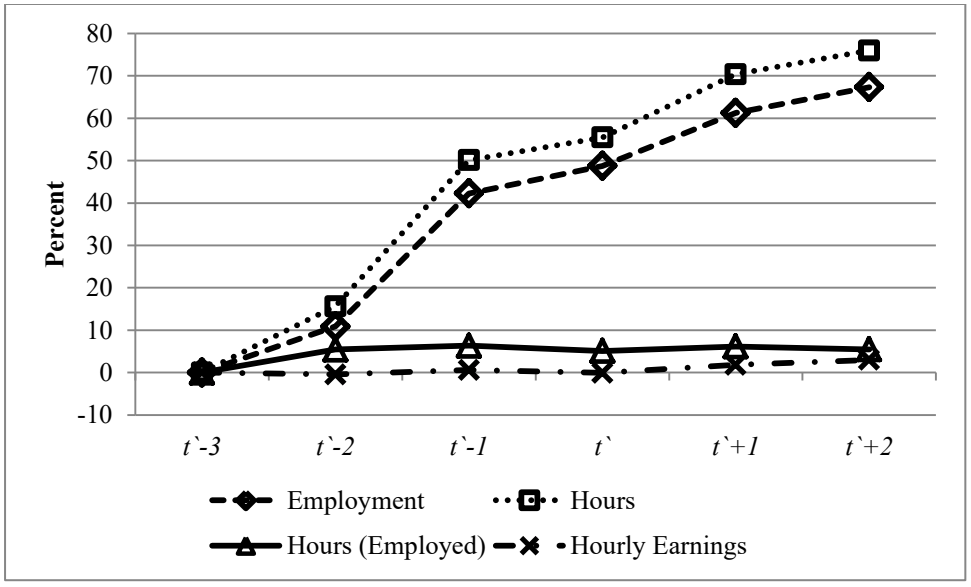
Von Wachter, T., Song, J. and Manchester, J. (2011) 'Trends in employment and earnings of allowed and rejected applicants to the social security disability insurance program', *American Economic Review*, 101(7), 3308-3329.

Figure 1(a) Percentage Change in Labour Market Outcomes over the Panel by WL Disability Onset



Notes: Data based on individuals in LLFS panel (2004-2010) with a minimum of 3 consecutive observations. The change is measured relative to (*t**-3).

Figure 1(b) Percentage Change in Labour Market Outcomes over the Panel by WL Disability Exit



Notes: See notes to Figure 1(a). The change is measured relative to (*t'*-3).

Table 1. Dynamic Patterns of WL Disability

	All	Male	Female	Older	Younger	High Quals	Low Quals
Irregular	5.60	5.70	5.49	7.01	4.47	4.89	6.33
Continuously Disabled	9.58	10.30	8.86	14.50	5.67	5.99	13.55
Consistent Onset	5.03	4.95	5.11	6.35	3.98	4.45	5.61
Consistent Exit	4.85	5.10	4.59	5.71	4.16	4.16	5.63
Continuously Non-disabled	74.95	73.94	75.96	66.42	81.72	80.51	68.88
N	71,331	35,550	35,781	31,553	39,769	36,795	33,818

Notes: Data based on individuals in LLFS panel (2004-2010) with a minimum of 3 consecutive observations.

Table 2. Disability and Employment Characteristics by Patterns of WL Disability

	Disabled				Non-disabled
	Irregular	Continuously Disabled	Consistent Onset	Consistent Exit	Continuously Non-disabled
Disability Characteristics					
Mental Health Problems					
Single	6.03	5.40	4.82	6.56	-
Multiple	1.44	2.77	2.83	2.02	-
All	7.47	8.17	7.65	8.58	
Physical Health Problems					
Single	44.70	20.41	37.73	51.54	-
Multiple	36.86	42.34	40.65	29.65	-
All	81.56	62.75	78.38	81.19	
Physical and Mental Health Problems	10.97	29.08	13.97	10.23	-
Employment Outcomes					
Employment	69.63	22.73	72.77	66.68	83.89
Hours	23.60	6.80	24.85	22.73	29.18
Hours (employed)	34.11	30.51	34.31	34.32	34.85
Hourly Earnings (£)	9.68	8.84	9.63	9.80	11.04

Notes: See notes to Table 1. With the exception of hours of work and hourly earnings (which refer to an average) all figures refer to the percentage within the relevant group. Employment and disability characteristics are measured in the first wave or, for those who do not reporting disability in wave 1, at onset.

Table 3. WL Disability Consistent Onset and Exit Effects

	Employment	% change	Hours	% change	Hours (employed)	% change	Log real hourly earnings
Onset (*t**-2)	0.007	1	0.693*	3	0.559**	2	-0.011
	(0.70)		(1.82)		(2.10)		(0.74)
Onset (*t**-1)	-0.004	-1	0.176	1	0.378	1	-0.021
	(0.40)		(0.44)		(1.40)		(1.30)
Onset (*t**)	-0.069***	-9	-2.380***	-9	-0.039	0	-0.044**
	(6.06)		(5.52)		(0.14)		(2.47)
Onset (*t**+1)	-0.125***	-16	-4.897***	-18	-0.970**	-3	-0.058**
	(8.90)		(9.34)		(2.42)		(2.36)
Onset (*t**+2)	-0.167***	-21	-6.288***	-23	-1.016	-3	-0.042
	(8.46)		(9.00)		(1.54)		(1.36)
Exit (*t*`-2)	-0.013	-3	-0.705	-5	-0.793	-2	-0.023
	(0.75)		(1.08)		(1.09)		(0.65)
Exit (*t*`-1)	0.011	2	0.074	0	-0.656	-2	-0.036
	(0.59)		(0.11)		(0.89)		(1.01)
Exit (*t*`)	0.043**	9	1.000	7	-0.574	-2	-0.032
	(2.34)		(1.47)		(0.78)		(0.90)
Exit (*t*`+1)	0.042**	9	1.085	7	-0.379	-1	-0.022
	(2.23)		(1.54)		(0.50)		(0.60)
Exit (*t*`+2)	0.040**	9	1.396*	9	-0.213	-1	-0.038
	(2.05)		(1.87)		(0.27)		(1.01)
N	247,763		244,658		185,487		138,017
Individuals	71,256		71,227		58,916		50,366
F-test	87.73 (0.00)		141.30 (0.00)		51.31 (0.00)		26.23 (0.00)
F-test (onset)	40.26 (0.00)		48.44 (0.00)		5.07 (0.00)		2.37 (0.04)
F-test (exit)	9.46 (0.00)		7.12 (0.00)		0.84 (0.52)		0.77 (0.57)

Notes: Coefficient estimates from the fixed effects model described by equation (1). Control variables (coefficients not presented) include time period, mode of interview, age and age squared, presence of children in the household, full-time student, highest educational qualification and marital status. The omitted group is (*t**-3) or (*t*`-3). Absolute T statistics are presented in parenthesis and *, **, *** denote significance at the 1, 5 and 10% level respectively. Percentage change figures are calculated relative to the omitted group (*t*\*-3 or *t*`-3). The F-tests for joint significance refer to all coefficients in the model, the onset coefficients and the exit coefficients respectively. In each case the p-value is presented in parenthesis.

Table 4. WL Disability Consistent Onset and Exit Effects by Personal Characteristics

	Hours					
	Male	Female	Older	Younger	High Quals	Low Quals
Onset (t*-2)	0.686	0.685	0.424	1.143*	0.298	1.072**
	(1.15)	(1.44)	(0.86)	(1.90)	(0.55)	(2.00)
Onset (t*-1)	0.336	0.034	-0.559	1.189*	0.316	0.043
	(0.55)	(0.07)	(1.07)	(1.94)	(0.56)	(0.08)
Onset (t*)	-3.144***	-1.648***	-3.443***	-0.959	-2.375***	-2.381***
	(4.72)	(3.03)	(6.09)	(1.45)	(3.92)	(3.92)
Onset (t*+1)	-6.569***	-3.322***	-6.378***	-2.878***	-5.007***	-4.762***
	(7.84)	(5.28)	(8.97)	(3.76)	(6.29)	(6.80)
Onset (t*+2)	-9.112***	-3.893***	-8.006***	-3.922***	-6.770***	-6.045***
	(7.89)	(4.79)	(8.18)	(4.14)	(6.00)	(6.77)
Exit (t`-2)	-1.061	-0.309	-0.242	-1.283	-0.658	-0.734
	(0.96)	(0.50)	(0.26)	(1.43)	(0.58)	(0.93)
Exit (t`-1)	-0.297	0.488	0.258	-0.174	0.152	0.007
	(0.27)	(0.74)	(0.27)	(0.19)	(0.13)	(0.01)
Exit (t`)	0.717	1.315*	1.077	0.862	0.974	1.034
	(0.64)	(1.93)	(1.12)	(0.92)	(0.84)	(1.26)
Exit (t`+1)	0.473	1.758**	0.894	1.232	0.578	1.561*
	(0.41)	(2.45)	(0.90)	(1.27)	(0.49)	(1.82)
Exit (t`+2)	1.012	1.816**	1.524	1.167	0.676	2.023**
	(0.83)	(2.34)	(1.46)	(1.11)	(0.54)	(2.19)
N	244,658		244,633		243,147	
Individuals	71,227		71,214		70,567	
F-test	104.42 (0.00)		104.67 (0.00)		104.10 (0.00)	
F-test (onset)	33.59 (0.00)	16.66 (0.00)	33.00 (0.00)	18.17 (0.00)	20.64 (0.00)	28.77 (0.00)
F-test (exit)	3.17 (0.01)	5.47 (0.00)	2.89 (0.01)	5.17 (0.00)	2.18 (0.05)	6.42 (0.00)
F-test group equality (onset)	6.08 (0.00)		3.28 (0.01)		1.02 (0.41)	
F-test group equality (exit)	0.58 (0.71)		0.81 (0.55)		1.50 (0.19)	

Notes: See notes to Table 3. The dependent variable is hours defined to include zero hours for the non-employed. The additional F-tests examine the equality of the onset (exit) coefficients across the samples defined by personal characteristics.

Table 5. WL Disability Consistent Onset and Exit Effects by Disability Characteristics

	Hours				
	Mental		Physical		Mental and Physical
	Multiple	Single	Multiple	Single	Multiple
Onset (*t**-2)	-2.953	1.731	1.150*	0.489	0.003
	(0.95)	(0.92)	(1.90)	(0.82)	(0.00)
Onset (*t**-1)	-3.271	-0.715	0.207	0.753	-1.146
	(1.04)	(0.33)	(0.34)	(1.21)	(0.89)
Onset (*t**)	-7.271**	-5.144**	-2.403***	-1.229*	-4.785***
	(2.39)	(2.30)	(3.61)	(1.85)	(3.44)
Onset (*t**+1)	-8.764***	-6.693***	-5.203***	-3.425***	-7.295***
	(2.61)	(2.89)	(6.47)	(3.83)	(4.82)
Onset (*t**+2)	-8.709***	-9.271***	-6.701***	-3.073**	-10.659***
	(2.62)	(3.62)	(6.25)	(2.59)	(5.58)
Exit (*t*`-2)	-6.690**	-1.884	0.992	-1.859	-1.371
	(2.15)	(1.22)	(0.80)	(1.52)	(1.55)
Exit (*t*`-1)	-3.303	-0.970	1.166	-0.994	-0.182
	(1.28)	(0.59)	(0.93)	(0.80)	(0.19)
Exit (*t*`)	-1.390	2.054	1.863	-0.632	2.404**
	(0.58)	(1.19)	(1.45)	(0.51)	(2.24)
Exit (*t*`+1)	-0.535	3.006	1.372	-0.378	3.519***
	(0.17)	(1.57)	(1.04)	(0.30)	(2.80)
Exit (*t*`+2)	0.747	1.917	2.617*	-0.457	4.328**
	(0.19)	(0.90)	(1.84)	(0.35)	(2.08)
N	243,021				
Individuals	70,745				
F-test	58.83 (0.00)				
F-test (onset)	4.11 (0.00)	8.36 (0.00)	22.50 (0.00)	8.42 (0.00)	14.74 (0.00)
F-test (exit)	2.16 (0.00)	3.96 (0.00)	1.59 (0.16)	1.60 (0.16)	5.32 (0.00)
F-test group equality (onset)	1.23 (0.29)		2.15 (0.06)		-
F-test group equality (exit)	0.74 (0.60)		1.01 (0.41)		-
F-test group equality (onset)	1.94 (0.01)				
F-test group equality (exit)	1.90 (0.01)				

Notes: See notes to Table 4.

Appendix 1. LLFS Panel Sample.

Descriptive statistics presented in Table A1 consider the representativeness of the LLFS panel (column iii) relative to the entire APS sample over the same period (column i) and the entire LLFS sample over the same period (column ii). Comparisons between (i) and (ii) provide an indication of the representativeness of the LLFS sample whereas the influence of attrition arising due to the focus on longitudinal information (more specifically 3 consecutive responses) is indicated by the comparison between (iii) and (ii). Differences between (ii) and (i) predominately relate to differences in the geographical distribution (and not personal characteristics) which occur as a consequence of the design of the LLFS. Differences in personal characteristics are more pronounced between (ii) and (iii) but appear entirely consistent with an underrepresentation of more mobile individuals, for example, those who are younger, students and non-white.

Table A1. Variable Means by Sample

	Variable Mean		
	(i) APS (2004-2010)	(ii) LLFS (2004-2010)	(iii) LLFS (2004-2010) with a minimum of 3 consecutive responses
WL Disability	15.10	15.49	16.68
Mental Single	7.27	7.12	5.85
Mental Multiple	2.66	2.90	2.29
Physical Single	33.05	31.02	31.95
Physical Multiple	36.27	36.18	38.44
Mental and Physical	20.75	22.79	21.48
Employment	72.74	71.93	75.84
Hours	25.40	25.07	26.18
Hours (employed)	35.11	35.06	34.65
Hourly earnings	10.53	10.76	10.79
Gender			
Female	49.50	49.69	50.16
Male	50.50	50.31	49.84
Age	38.49	38.21	41.48
Highest qualification			
Degree	18.63	17.53	18.63
Other Higher Education	8.59	8.97	10.72
A level	22.68	22.89	22.75
O level	22.62	22.53	22.34
Other	12.06	12.14	10.14
None	15.42	15.94	15.42
Students			
Full-time student	8.48	8.42	5.82
Not full-time student	91.52	91.58	94.18
Ethnicity			
White	90.15	90.73	94.22
Non-white	9.85	9.27	5.78
Marital Status			
Single	39.13	39.95	28.81
Married	48.22	46.98	58.10
Widowed/divorced	12.65	13.07	13.10
Children			
Dependent child in household	39.07	39.19	41.95
No dependent child in household	60.93	60.81	58.05
Region			
Tyne and Wear	2.68	3.73	3.04
Rest of North East	3.46	4.85	4.33
Greater Manchester	5.19	6.68	6.22
Merseyside	2.63	3.35	3.24
Rest of North West	4.43	3.63	3.37
South Yorkshire	2.18	2.00	1.78
West Yorkshire	2.92	1.36	1.22
Rest of Yorkshire & Humberside	3.00	3.35	3.12
East Midlands	5.45	2.57	1.99
West Midlands Metropolitan county	3.95	3.82	3.46
Rest of West Midlands	3.80	2.69	2.69
East of England	6.82	3.33	2.86
Inner London	4.17	4.06	2.37
Outer London	5.46	3.38	2.60
South East	11.58	8.88	7.75
South West	7.37	6.35	5.93
Wales	9.60	16.89	19.48
Strathclyde	5.57	8.42	10.50

Rest of Scotland	7.32	10.67	14.05
Northern Ireland	2.41	-	-
Year of observation			
2004	23.89	27.34	28.04
2005	15.09	16.73	20.21
2006	12.57	11.36	18.11
2007	12.48	10.95	16.70
2008	12.20	10.98	16.94
2009	11.86	11.11	-
2010	11.90	11.52	-
Interview type			
Face-to-face	78.67	72.02	79.28
Telephone	21.33	27.98	20.72
Sample			
QLFS	60.01	-	-
LLFS	39.99	100.00	100.00
N	890,715	356,181	71,335

Notes: Characteristics measured at the first point of contact. The APS sample excludes the APS boost.

Appendix 2. The Type and Number of Health Problems.

Each individual who reports a long-term health problem (*Do you have any health problems or disabilities that you expect will last for more than a year?*) is asked to indicate the nature of their health problem(s) from a list of the following 17 possible responses: (1) problems or disabilities connected with your arms or hands; (2) ...legs or feet; (3) ...back or neck; (4) difficulty in seeing (5) difficulty in hearing; (6) a speech impediment; (7) severe disfigurements, skin conditions, allergies; (8) chest or breathing problems, asthma, bronchitis; (9) heart, blood pressure or blood circulation problems; (10) stomach, liver, kidney or digestive problems; (11) diabetes; (12) depression, bad nerves or anxiety; (13) epilepsy; (14) severe or specific learning difficulties; (15) mental illness or suffer from phobias, panics or other nervous disorders; (16) progressive illness not included elsewhere (17) other health problems or disabilities. Individuals are asked to indicate *all that apply*. In a separate question individuals are also asked to provide their *main* health problem from the same list of responses. The proportion of WL disabled individuals reporting each type of health problem is presented in Table A2. An indicator for multiple health problems is derived from the number of separate health problems reported. The proportion of disabled individuals reporting a given number of separate health problems is presented in Table A3.

Table A2. Type(s) of Health Problem Reported by Disabled Individuals

Main Health Problem	Percentage of disabled individuals
Arms or hands	25.47
Legs or feet	31.98
Back or neck	35.99
Difficulty in seeing	5.44
Difficulty in hearing	7.77
Speech impediment;	1.66
Severe disfigurements, skin conditions, allergies	9.22
Chest or breathing problems, asthma, bronchitis	20.41
Heart, blood pressure or blood circulation problems	25.61
Stomach, liver, kidney or digestive problems;	14.68
Diabetes	8.08
Depression, bad nerves or anxiety	18.92
Epilepsy	3.01
Severe or specific learning difficulties	4.05
Mental illness or suffer from phobias, panics or other nervous disorders	9.64
Progressive illness not included elsewhere	6.58
Other health problems or disabilities[a]	13.60
N	17,836

Notes: See notes to Table 1. Health problems are measured at the first point of disability reporting. [a]This is not classified as either a mental or physical health problem. Percentages will sum to more than 100 since individuals can report more than one health problem.

Table A3. Number of Separate Health Problems Reported by Disabled Individuals

Number of Health Problems	Percentage of disabled individuals
1	43.68
2	21.03
3	13.80
4	8.15
5	5.57
6+	7.79
N	17,859

Notes: See notes to Table 1. Health problems are measured at the first point of disability reporting.

Appendix 3. Graphical Representation of Regression Coefficients

Figure A1(a) WL Disability Onset and Hours of Work by Gender

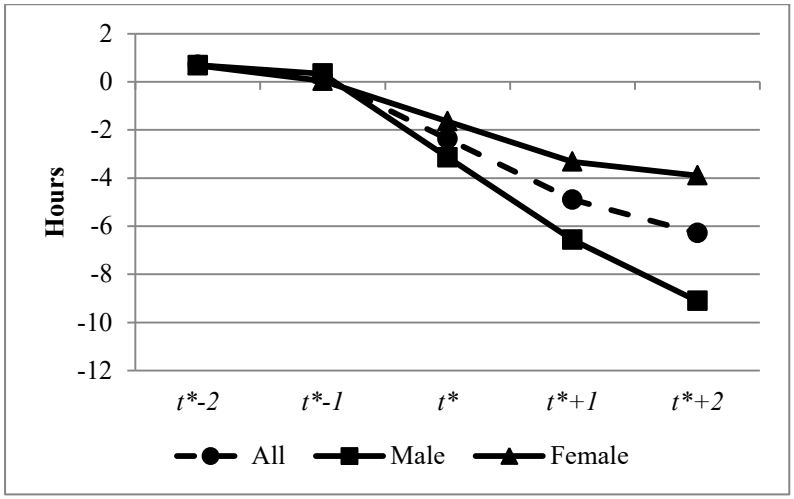
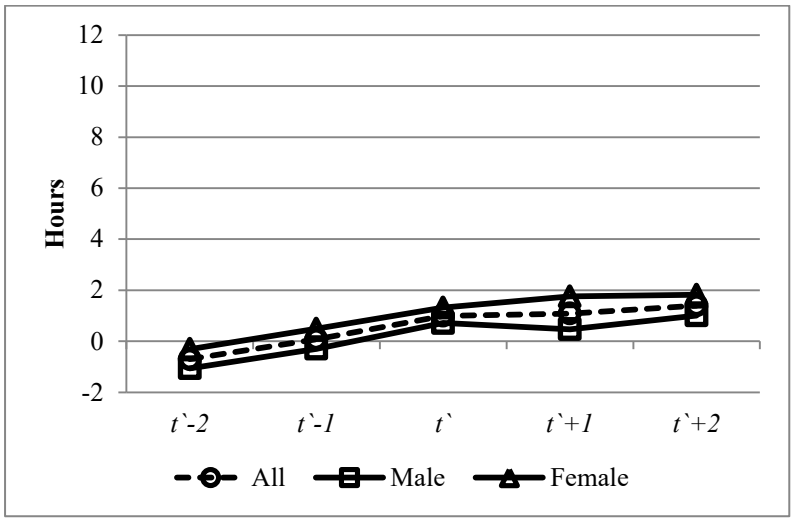
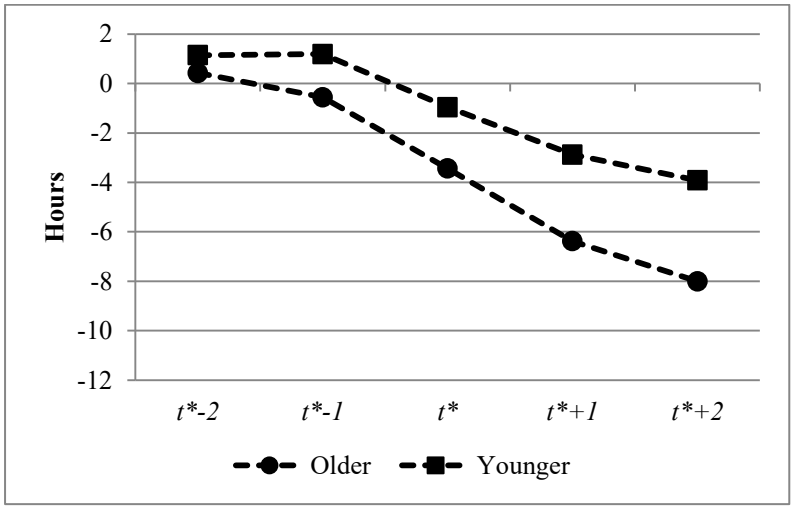


Figure A1(b) WL Disability Exit and Hours of Work by Gender



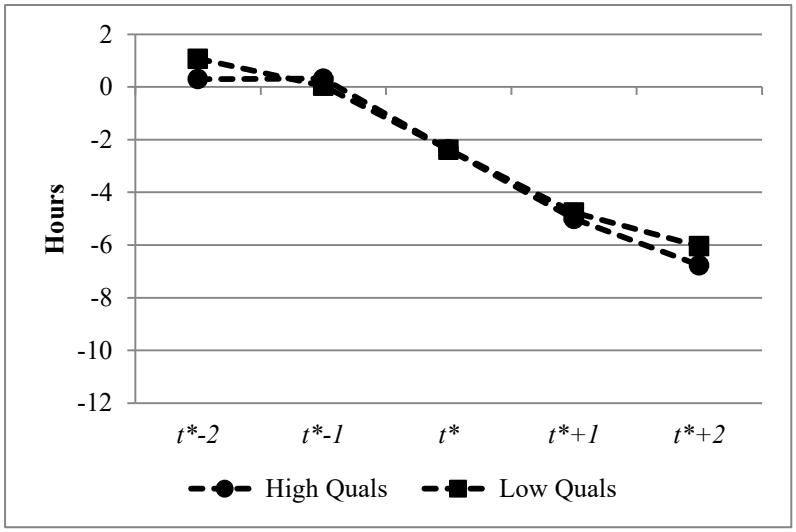
Notes: Figures represent coefficient estimates from equation 1 presented in Tables 3 and 4.

Figure A2 WL Disability Onset and Hours of Work by Age



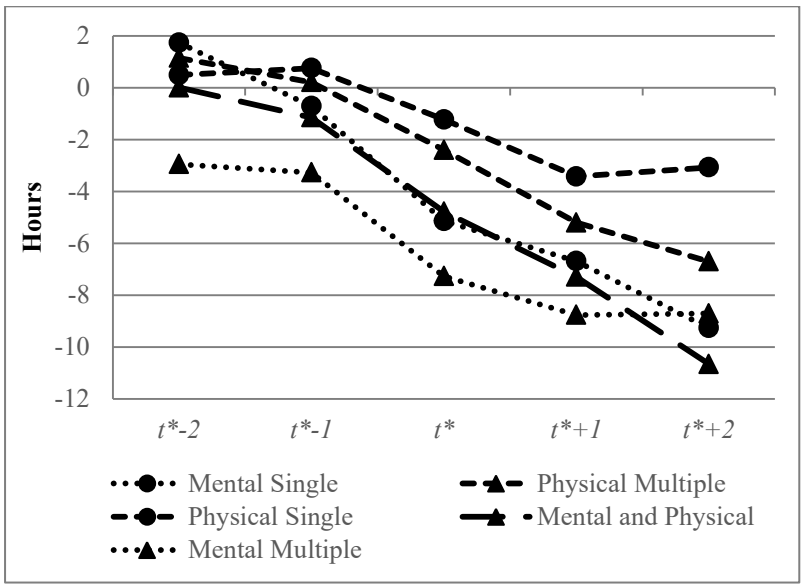
Notes: See notes to Figure A1.

Figure A3 WL Disability Onset and Hours of Work by Qualifications



Notes: See notes to Figure A1.

Figure A4 WL Disability Onset and Hours of Work by Type and Severity



Notes: Figures represent coefficient estimates from equation 1 presented in Table 5.